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HYBRID HINGE AND AN ELECTRONIC DEVICE COMPRISING THE HYBRID HINGE

FIELD OF THE INVENTION

The invention relates to a hybrid hinge for rotatably arranging a first segment with respect to a second segment, wherein the first segment and/or the second segment are rotatable about a shaft.

The invention further comprises an electronic device comprising the hybrid hinge.

BACKGROUND OF THE INVENTION

Hinges are widely applicable for adjoining segments, notably of an apparatus, which are conceived to be rotated with respect to each other about a shaft. Hinges between two segments can either be realized by a rigid hinge having a shaft and thereby defining a sole axis of rotation for the segments, or by an elastic hinge, also known as a living hinge or an elastic hinge. An example of the rigid hinge is a butt-hinge comprising the shaft that runs through suitable openings in the two joined segments. The living hinge is usually manufactured from a relatively thin elastic material. The elasticity of an elastic hinge gives the adjoining segments the freedom to rotate with respect to each other, however the rotation axis is not fixed. Therefore, this kind of hinge also gives some freedom for the adjoining segments in other directions than rotation alone. Deformation of the living hinge other than a direction of the rotation around the intended sole axis of an apparatus can cause damage to the apparatus, in particular to parts that bridge the hinge.

It is a disadvantage of the known rigid hinge in that it is comparatively voluminous requiring a substantial space in an apparatus. In addition, gaps are present between the displaceable segments due to the construction of the rigid hinge. It is a disadvantage of the living hinge in that it does not have a well determined axis of rotation allowing for the segments to be twisted with respect to each other.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an improved hinge.

To this end the hinge according to the invention comprises a rigid hinge comprising a shaft and an elastic hinge cooperating with the rigid hinge and extending at least partially over an area of the first segment and the second segment.

The technical measure of the invention is based on the insight that by addition of the live hinge to a per se known rigid hinge an improved hinge is provided wherein the sole axis of rotation is defined by the shaft of the rigid hinge and wherein the movement of the segment with respect to each other is enabled in a smooth fashion due to elastic properties of the elastic hinge. In addition the elastic hinge adds strength to the rigid hinge, while requiring a minimum of additional space in the device.

The elastic hinge may comprise thin sections of plastic that connect two segments allowing them to be rotatable with respect to each other. The suitable materials for manufacturing elastic hinges preferably relate to a very flexible plastic, such as polypropylene and polyethylene. These materials can flex more than 1000 times without losing their elastic properties. In order to manufacture such elastic hinges the molecules of the suitable plastic have to be oriented substantially parallel to the envisaged hinge axis. Such orientation is achieved during a carefully selected moulding process, comprising the

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steps of flexing and coining. Due to the coining step the strain induced in the elastic hinge is greater than the yield stress of the plastic. This will result in a plastic deformation of the hinge in use. Preferably, the elastic hinge has a thickness in a range of 0.25-0.5 mm. This keeps the mechanical stress in the outer fibers from exceeding the stress when the hinge is bent. It is noted that the manufacturing of the elastic hinge may comprise a step of heating the hinge or the coining at temperatures below the glass transition temperature of the plastic for easier coining and for improving the properties of the elastic hinge.

In an embodiment of the hybrid hinge according to the invention the elastic hinge is arranged for substantially sealing an area between the first segment and the second segment. This feature is advantageous particularly for devices comprising a lid or a cover, like portable computers, mobile telephones and the like wherein the interior of the device behind the lid has to be protected from environment. Due to the fact that the segments are rotating without leaving open areas between them, the contamination of the device comprising such hybrid hinge is substantially reduced thereby increasing durability of the device. Preferably, the elastic hinge comprises a stretchable material such as, for example, polyethylene or polypropylene. It is found to be advantageous to use a bendable polymer for the elastic hinge.

In an embodiment of the hybrid hinge according to the invention, the rigid hinge is arranged inside the elastic hinge. Due to this feature the rigid hinge and the elastic hinge have a mutual axis of rotation decreasing undesired stress in the elastic hinge.

The electronic device according to the invention comprises a hybrid hinge as set forth with reference to the foregoing. In an embodiment of the electronic device according to the invention a layer of material is extended at least partially over the first segment and the second segment. Preferably, the layer of material comprises a display, notably a flexible display. In a further embodiment of the electronic device according to the invention the flexible display is arranged to be alternated between a collapsed state and a retracted state.

These and other aspects of the invention will be discussed in more detail with reference to drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 presents a schematic view of an embodiment of a hybrid hinge according to the invention.

FIG. 2 presents a schematic view of the embodiment of FIG. 1 in a closed state.

FIG. 3 presents a schematic view of an embodiment of a part of the electronic device according to the invention.

FIG. 4 presents a schematic view of a further embodiment of the electronic device according to the invention.

DETAILED DESCRIPTION

FIG. 1 presents a schematic view of an embodiment of a hybrid hinge according to the invention. In the exemplary embodiment 10 hybrid hinges 7, 8 according to the invention are used for rotatably adjoining segments S1, S2, S1' of a suitable electronic apparatus. It will be appreciated that such hinges are applicable to a great variety of electronic devices such as, for example portable computers, mobile phones, palmtop computers, electronic organizers, mobile music devices or the like. The hybrid hinge 7, 8 comprise respective rigid hinges 2, 4 arranged to rotate the segments S1, S2, respectively S2, S1' about respective shafts 2a, 4a. Preferably, the shafts 2a, 4a protrude through the whole device 10 to the